NOTES ON SOME ASTRAGALUS SPECIES OF ECUADOR AND PERU

IVAN M. JOHNSTON

THE SPECIES here discussed are plants of Ecuador and west-central and northern Peru. They represent the few South American species of the genus which have not been discussed in my forthcoming revision of the *Astragalus* species of Bolivia, Chile and Argentina. Though these few northern species are well marked, to have included them in my larger paper would have disproportionately complicated the keys to the very abundant and generally less well marked more southern species. Practical considerations have, therefore, demanded a separate treatment of the present outlying northern species of South America. Since the Galapagos Islands are territory belonging to Ecuador I have given notes on the identity and probably true home of the two species of *Astragalus* based upon specimens falsely said to have come from those islands.

The abbreviations of herbaria used in this paper are as follows: BD = Berlin-Dahlem; BM = British Museum; Boiss. = Boissier Herbarium, Geneva; FM = Field Museum, Chicago; G = Gray Herbarium, Harvard Univ.; K = Kew; Stock. = Stockholm; US = United States National Herbarium.

Astragalus Sprucei, sp. nov.

Prostrata gracilis, e radice gracili perenni oriens; caulibus gracilibus 1–1.5 mm. crassis 1–5 dm. longis sparse longiramosis plus minusve minute pallide strigosis; foliis numerosis; rhachi 4–7 mm. longa sparse strigosa internodiis caulis 1–3 cm. longis evidenter longiore; foliolis 9–13-jugis oblongis vel oblongo-obovatis vel late cuneatis basim versus attenuatis glabris vel subtus in costa sparse strigosis apice latis conspicue emarginatis; stipulis dorsaliter connatis 5–7 mm. longis pallide chartaceis laxe ocreatis apice 1–1.5 mm. profunde bidentatis; floribus 3–6 parvis; racemis quam folia ½ vel ⅓ brevioribus; pedunculis axillaribus 5–20 mm. longis gracilibus maturitate decurvatis; bracteis ovatis chartaceis acutis 1–2 mm. longis; pedicellis ca. 1 mm. longis; calycibus 2.5–3.5 mm. longis extus sparse strigosis, tubo cupulato 1.5–2 mm. longo et crasso, lobis lanceolatis 1–2 mm. longis; vexillo ca. 5 mm. longo caeruleo medio albo-picto, lamina suborbiculata ca. 5 mm. diametro; alis caeruleis angustis ca. 4 mm. longis; carina alba obtusa ca. 3 mm. longa; ovario striguloso; leguminibus prismaticis ascendentibus sparse strigosis

straminaceis 8–12 mm. longis 4–6 mm. crassis 2–4 mm. altis uniloculari-bus, plus minusve dorsiventraliter compressis cum partibus inferioribus leguminis subplanis vel plus minusve lateraliter compressis cum partibus inferioribus leguminis late introflexis; seminibus 6–8 brunneis ca. 1.8 mm. longis compressis oblique ovatis.

ECUADOR. TUNGURAHUA: Tilulún, near Ambato, Feb. 1919, *Pachano 117* (US). CHIMBORAZO: Riobamba in sandy places, fl. violaceous, Nov. 1858, *Spruce 5771* (TYPE, Gray Herb.; K, BD, Stock.); in gravel along the Rio Chambo, Dec. 1858, *Spruce 5811* (K, BD, Stock.); repent in sandy fields, Riobamba, Dec. 1922, *Mille A17* (BD); sandy hills, Riobamba, May 1921, *Rimbach 148* (BD); dry interandine highland, small half-shrub in sandy soil, Riobamba, 2800 m., *Rimbach 202* (US); without locality, *Pearce* (BM) and *Jameson* (US).

Related to the habitually very dissimilar *A. micranthellus* Wedd. and *A. arequipensis* Vogel, perennials of the Bolivian plateau, and to *A. triflorus* (DC.) Gray, an annual of the coastal hills of Peru and northern Chile. All these related species have small racemose flowers borne on abbreviated peduncles much shorter than the leaves, as well as usually flat, non-complicate, leaflets and ascending legumes. The pods of *A. Sprucei* have no false septum or, at most, only an extremely narrow very weakly developed and inconspicuous one. Though the walls of the pod are tough they are not very thick. The total width of the fruit is usually ½ to ⅓ their total length and is evidently greater than its dorsi-ventral measurements (i. e. height). The pod may be angled along its entire upper edge or only along its distal half, the half of the pod next the pedicel being frequently somewhat flattened dorsally and the superior suture somewhat inflexed. The fruit is essentially triquetrous and broadly prismatic. The very broad lower face of the fruit may remain flat but it usually becomes broadly inflexed for its total length thus causing the pod to appear folded.

Astragalus Weberbaueri Ulbrich, Bot. Jahrb. **37:** 419 (1906).

Infrequent in the mountains of northern Peru and central Ecuador.

PERU. CAJAMARCA: below San Pablo, 2200–2400 m., shrubby, ca. 5 dm. tall, *Weberbauer 3869* (TYPE, Berlin); Montana de Nancho, Nov. 23, 1874, *Raimondi 8294* (BD). PIURA: above Palambla, cordilleras west of Huancabamba, 2700–3200 m., spreading shrub, April 1912, *Weberbauer 6035* (BD) and *6050* (G, US, FM, BD). ECUADOR. PICHINCHA: Quito, *Jameson* (K). CAÑAR: below paramo, near Cañar, Sept. 16, 1918, *Rose & Rose 22776* (US) Paramo de Chaning, andes east of Azogues, 3000–3400 m., *Lehmann 5357* (K).

This species has elongate sparsely branched erect stems which become somewhat shrubby below. Its habit, subglabrous yellowish olive-green leaves, large corollas and brownish calyces give the plant a very distinctive aspect. The ovary is strigose. The sparsely strigose mature fruit is 10–14 mm. long, more or less reflexed and triquetrous and prismatic. The three subequal faces of the legume are 4–5 mm. broad. The lower face may be flattened or more or less inflexed. Viewed from the side the upper edge may be nearly straight or broadly convex in outline. The lower edge is usually more strongly convex in outline and more abruptly contracted into the slender (1.5–3 mm. long) persistent stylar beak. The base of the fruit is rounded in lateral outline. Inside the pod there is a weakly developed false septum 0.5–1 mm. high.

The gross habit of *A. Weberbaueri* is somewhat suggestive of a coarse form of *A. Garbancillo*. Our plant, however, may be quickly distinguished from that variable and widely ranging species by its larger, glabrescent deflexed legumes with rudimentary rather than well developed false septum, and its glabrescent olivaceous herbage, and besides it has a detached distinctly more northern geographical range.

Astragalus geminiflorus Humb. & Bonpl. Plant. Aequat. **1:** 128, tab. 37 (1808); Weddel, Chlor. Andina **2:** 258 (1861).

Endemic to the volcanic peaks of Ecuador at altitude between 4000 and 5000 meters.

ECUADOR. PICHINCHA: east side of Cayambe, upper paramo, 4300 m., March 1871, *Stübel 113* (BD); Rucu-Pichincha, 1923, *Anthony & Tate 170* (S); Pichincha, en una hondonada del "Padre Encantado," 4400 m., 1928, *Firmin 586* (US); Mt. Pichincha, 4100–4500 m., *Hitchcock 21067* (G, US); north side of Pichincha, 1870, *Stübel 39* (BD); Pichincha, 1855, *Couthouy* (G); summit of Pichincha, March 18, 1849, *Jameson* (Paris); sides of crater and volcanic summit, Pichincha, *Jameson 68* and *28* (K); west side of Antisana, ca. 4500 m., March 1880, *Whymper* (BM); Antisana, 4500 m., 1923, *Anthony & Tate 289* (US); Antisana, *Humboldt & Bonpland* (Paris, TYPE; BD); Corazon, paramo, 4200 m., *Stübel 22A* (BD); summit of Rumiñahui, 4750 m., 1920, *Holmgren 954* (Stock.). LEON: Vallevicioso, base of Cotopaxi, Oct. 1856, *Remy* (Paris); Cerro de Cotopaxi, *Jameson* (US); Iliniza, Atatinqui, in paramo, Jan. 1874, *Stübel 299* (BD). CHIMBOROZO: Chimborozo, 4200 m., June 1860, *Spruce* (K); Chimborozo loose blowing sand, 4950 m., Dec. 25, 1826, *Jameson* (K); Chimborozo near Totorillas, loose drifting volcanic sand near snow-line, 4600 m., July 7, 1876, *Andre 3949* (K); dunes at base of Chimborozo, Nov., 1856, *Remy* (Paris);

Arenal de Chimborozo, 4200–4500 m., *Lehmann 418* (K, BM, US); Chimborozo near snow-line, *Hartweg 957* (K, BM, BD, Boiss., Paris), northwest side of Chimborozo, 4700 m., 1903, *Mayer 79* (BD).

A very well marked species with its abundant coarse stems trailing in volcanic sand. The leaves are silvery and have very numerous small crowded leaflets. The flowers are usually solitary in the leaf-axils. The ascending fruit is silky strigose, like the herbage, and is usually found persistent on the buried stems of past years. Its lower suture is strongly inflexed. Inside the fruit there is an evident false septum which becomes at least 1 mm. high and is usually hairy. The species is a relative of *A. Garbancillo* and *A. Pickeringii,* of central Peru.

Astragalus Cracca De Candolle, Astrag. 101, tab. 9 (1802) and Prodr. **2:** 284 (1825).

Astragalus ocrosianus Ulbrich, Bot. Jahrb. **37**: 419 (1906).

Semi-desert western slopes of the Peruvian Cordilleras east and northeast of Lima.

PERU. ANCASH: Ocros, ca. 3300 m., 1903, *Weberbauer 2666* (FM; Berlin, TYPE of *A. ocrosianus*). LIMA: Purrochuca, *Mathews 550* (BM); Huamantanga, *Mathews 550* (K); prov. Canta, *Mathews* (K); Cerro de Surco, *Ramondi 11908* (BD); near Canta, open grassy hillside, ca. 3100 m., 1925, *Pennell 14607* (G, US, FM); Canta, open rocky slope, ca. 2800 m., 1925, *Pennell 14345* (G, FM); Matucana, loose soil on steep hillside, ca. 2400 m., 1922, *Macbride & Featherstone 293* (FM).

A species known only from west-central Peru. The laxly branched stems are spreading or decumbent from a slender perennial root. The ovary is glabrous. The reflexed glabrous pods are 10–17 mm. long. At first they are more or less three-faced with the flattened (slightly the broadest) lower face 4–5 mm. broad, but finally at maturity they become laterally compressed with the lower face strongly and deeply inflexed. There is an incomplete papery false septum becoming 1 mm. high.

The species is most closely related to *A. Weberbaueri* of northern Peru and Ecuador, from which it differs in its glabrous ovary and fruit, much smaller flowers, much shorter more slender spreading stems, and distinctly brighter green herbage. The herbage of *A. Cracca* is sparsely pale-strigose, the new growths may be somewhat cinereous but the older parts tend to be glabrescent and green. It is never olivaceous as in *A. Weberbaueri.* The structure, size and shape of the pods in these two species are similar. The gross habit of *A. Cracca* is very similar to that of *A. Richii,* but our plant has a very much more scanty indument, and hence is more or less glabrescent, rather than cinereous as in the rather

copiously strigose *A. Richii*. The pods of *A. Cracca* are, furthermore, distinctly deflexed and glabrous. Those of *A. Richii* are strigose, somewhat inflated and ascending or only erratically and laxly reflexed.

When *A. Cracca* was first published by de Candolle it was given as from Peru without any indication as to who collected the type or as to the locality where it was found. Later in the Prodromus he again attributed the species to Peru but added the note, "v. s. olim in herb. Desf.," which suggests that the type may be in the Webb Herbarium at Florence. At Paris there are some collections labelled as collected in Chile by Dombey. These are very similar to the plant illustrated and described by de Candolle and I believe them to be isotypes of the species. I suspect that the type of *A. Cracca* was collected by Dombey, probably near Canta, Peru. The species is most certainly not Chilean.

Astragalus Richii Gray, Bot. U. S. Explor. Exped. **1**: 414 (1854).

Astragalus macrorrhynchus Ulbrich, Bot. Jahrb. **37**: 420 (1906).

Western slopes of the Andes in central and southern Peru.

PERU. LIMA: along the ascent to Obrajillo, May 1839, *Wilkes Exped.* (US, TYPE of *A. Richii;* G); Matucana, 1922, *Macbride & Featherstone 214* and *351* (FM); between Matucana and Tambo, 1901, *Weberbauer 112* (BD, TYPE of *A. macrorrhynchus*). AREQUIPA: southern slopes of Chachani, 3355 m., 1920, *Hinkley 20* (G); near Arequipa, 2700 m., 1925, *Hopp 25* (BD); Arequipa 1892, *Douglas* (G); Arequipa, 2800–2900 m., 1925, *Pennell 13241* (G, US, FM, BD). TACNA: near Lake Huananhuata, Candareve, March 1925, *Weberbauer 7365* (G, US, FM, BM, BD).

A species much resembling *A. Cracca*, but ranging to the south of that species and differing from it in the less triquetrous and more inflated strigose pods. The flowers after anthesis and the maturing fruit of *A. Richii* seem to have spreading or loosely recurved pedicels. They are not so distinctly reflexed as in *A. Cracca*, *A. Weberbaueri* or *A. Sprucei*. The pods of *A. Richii* have no false septum.

Astragalus alienus Gray, Bot. U. S. Explor. Exped. **1**: 418 (1854).

Astragalus imputatus Macbride, Candollea **5**: 370 (1934).

Western slopes of the Andes east and northeast of Lima, Peru.

PERU. LIMA: Above Baños, "midrib of leaves persistent, and becoming spinescent; on the sloping summit of the ridge that forms the northern border of the Chancay Valley, rare," May 1839. [*Pickering*] *Wilkes Exped.* (US, TYPE of *A. alienus;* G); Rio Blanco, open hillside, shrub with subprostrate branches, ca. 3250 m., April 1929, *Killip & Smith*

21739 (FM, TYPE of *A. imputatus;* NY, US); Altos de San Mateo, May 1876, *Raimondi 12128* (BD).

This remarkable plant is known only from the three collections cited. The leaflets are very small and deciduous from the stiffish slender leaf-rachis which persists as a weak elongate spine. These slender spines are morphologically equivalent to those found in a large group of species of the Old World. This homology and the resulting great similarity in gross aspect between this Peruvian plant and those of the Old World has suggested that possibly some direct relationship may exist between these widely separated plants. The similarities, however, may be dismissed as merely parallel evolution. Our plant is evidently related to *A. Garbancillo,* a species in which the leaf-rhachises frequenty persist after the leaflets have fallen. A study of any large series of Peruvian *A. Garbancillo* will reveal many evidences of this habit, which is merely intensified in *A. alienus.* Our plant is not directly related to the spinescent species of Asia!

Macbride distinguished *A. imputatus* from *A. alienus* by attributing to the former subacute green rather than retuse canescent leaflets, larger flowers (17 mm. rather than 12 mm.) and a more shallowly lobed calyx. However, the younger leaves of *A. imputatus* are as canescent as those in *A. alienus.* The leaflets of *A. alienus* are actually acutish rather than retuse. The differences in flower-size and calyx-proportions are of minor importance if we may judge of their variability in *A. Garbancillo.* Finally the two plants come from a small natural area from which we can hardly expect two species so evidently related as *A. alienus* and *A. imputatus.*

Astragalus Pickeringii Gray, Bot. U. S. Explor. Exped. **1:** 415 (1854).

Astragalus Pickeringii var. *serpens* Ball, Jour. Linn. Soc. London, **22:** 36 (1885).

Astragalus Garbancillo var. *varus* Macbride, Field Mus. Publ. Bot. **8:** 99 (1930).

High altitudes of central Peru.

PERU. LIMA: Rio Blanco, 4500 m., 1922, *Macbride & Featherstone 776* (FM); Casapalca, ca. 4200 m., April 22, 1882, *Ball* (K, TYPE of var. *serpens;* G); between Casa Cancha and Culmai, *Wilkes Exped.* (US, TYPE of *A. Pickeringii;* G); Ticlio, on hillside, 1929, *Ledig 32* (US). JUNIN: Cerro de Pasco, *Mathews 592* (BM); Cerro de Pasco, 4200 m., *Macbride 3068* (FM); Shelby, 4050 m., June 1922, *Macbride & Featherstone 1090* (FM); high plains near Junin, 3900 m., *Mackenzie* (US, FM; between Tarma and Jauja, 4500 m., 1929, *Killip & Smith 23370* (US); near Oroya, *Kalenborn 133* (G, US). ANCASH: Pomo-

pampa, 4200 m., *Macbride & Featherstone 2499* (FM, TYPE of var. *varus*). HUANUCO: Chavanillo, caespitose on upland grassland, ca. 2400 m., Aug. 1922, *Macbride & Featherstone 2308* (FM); Chasqui near Mito, grassy subalpine slopes, April 1923, *Macbride 3295* (FM).

Assembled here is a group of plants which is evidently related to *A. Garbancillo* and probably derived from it. The characters of these plants, their reduced dense habit of growth, short internodes, small leaves, few-flowered short-pedunculate inflorescences, are all modifications to be expected in plants growing in alpine conditions at high altitudes. Curiously, however, although *A. Garbancillo* is one of the most widely ranging of South American *Astragalus*, growing from Tucuman and Mendoza in Argentina north to central Peru and so adjacent to many areas of puna and high mountain slopes, it has produced a marked, depauperate, high-altitude form only in *A. Pickeringii* and that only in central Peru at the northern limit of its geographical range. Our plant is probably only an ecotype, but because of its extreme departure from its probable parent-form and its relatively restricted range, I believe it will be convenient to treat it as a species. I have not seen a complete series of intergrades, connecting *A. Pickeringii* and *A. Garbancillo*, but such collections as *Macbride & Featherstone 945* from Oroyo (which must be referred to *A. Garbancillo*) and *Killip & Smith 23370* from between Tarma and Jauja (which is evidently robust *A. Pickeringii*) do indicate that the two species do approach one another and that a complete series of intergrades probably do exist in nature.

In *A. Pickeringii* the leafy stems (annual growths) may reach 8 cm. in length and have internodes as much as 1 cm. long. On the other hand they may be very much shortened or even suppressed with the plant more or less cespitose and the leaves even tufted on the crowns of the coarse branched subterranean caudex. The 1–6 (usually 2–4) flowers are congested on peduncles 0.5–6 (usually less than 2) cm. long which are conspicuously overtopped by the leaves. The corolla and fruit are those of *A. Garbancillo*. The leaves, stems, and stipules usually have a dense pale silky indument. The peduncles are frequently spreading or decurved.

The collections from the department of Huanuco have been determined by the collector as *A. geminiflorus*, but that is certainly incorrect. Though at first I considered them to represent an undescribed species further study and comparison with *A. Pickeringii* has convinced me that they are merely the ultimate habital reduction in that species. Tendencies towards their extreme cespitose habit may be observed in collections I have cited from Lima and Junin.

Astragalus romasanus Ulbrich, Bot. Jahrb. **37:** 421 (1906).

PERU. ANCASH: Pampa Romas, between Samanco and Caraz, spreading half-shrub, 3400–3500 m., May 30, 1903, *Weberbauer 3209* (BD, TYPE).

The status of *A. romasanus* is uncertain. Further collection from Ancash are needed before we can determine its relations to *A. Pickeringii* and *A. Garbancillo*. It differs from the latter in having short slender leafy stems 1–5 cm. long, and, perhaps, slightly smaller flowers and more elongate pods. Its abbreviated stems suggest *A. Pickeringii,* but its caudex is diffuse, its stems much more slender, its peduncles more slender and elongate, its flowers loosely racemose, and its much smaller leaves and leaflets glabrous above.

Astragalus Brackenridgei Gray, Bot. U. S. Explor. Exped. **1:** 416 (1854).

Astragalus salubris Macbride, Field Mus. Pub. Bot. **11:** 25 (1931).

Known only from high altitudes in the Andes of central Peru.

PERU. JUNIN: Shelby, 4000 m., June 8, 1922, *Macbride & Featherstone 1089* (FM); Morococha, 4500 m., 1922, *Macbride & Featherstone 889* (FM); Cord. de Morococha, *Martinet 1531* (Paris); Hacienda Atocsaico near Junin, 1923, *Hitchcock 22189* (US); Cerro de Pasco, 1927, *Sawada P86* (FM, TYPE of *A. salubris*); Tuapata, 3750 m., 1916, *Watkins* (US). LIMA: puna above Baños, *Wilkes Exped.* (US, TYPE of *A. Brackenridgei*).

This species is clearly related to *A. arequipensis* Vogel, which ranges at high altitudes from southern Peru south into northern Argentina, and perhaps is no more than a geographic variant of that species. It differs from its southern relative only in its smaller proportionately broader oblong (rather than lunate) fruit and in its generally smaller narrower leaflets. These differences are not always decisive.

Astragalus Edmonstonei (Hook.) Robinson, Proc. Amer. Acad. **38:** 148 (1902).

Phaca Edmonstonei Hooker, Trans. Linn. Soc. London, **20:** 227 (1847).

This species is based upon material collected by Thomas Edmonstone which is labelled as from the Galapagos Islands. The type collection, however, is without any doubt that well known coastal plant of central Chile which has been described as *Phaca flava* H. & A. and *Phaca chrysantha* Moris. Since neither of these two earlier specific names may be applied to the Chilean species of *Astragalus,* because of earlier homonyms, the name *A. Edmonstonei* becomes the valid name of the species.

Edmonstone, who was botanist on the exploring ship, *Herald*, was killed while in Ecuador. There is other evidence that parts of his collection became confused after his death. There can be little doubt that he collected his material of the *Astragalus* near Valparaiso where he is known to have botanized in Nov. 1846. The species is not a plant of the Galapagos Islands.

Astragalus brevidentatus Wright, Kew Bull. **1906:** 200.

This species, said to be from the Galapagos Islands, is based upon a flowering specimen received by Hooker from Decaisne. This specimen, apparently a duplicate of the collection by Du Petit Thouars mentioned by Hooker when he described *Phaca Edmonstonei*, though attributed to the Galapagos Islands, was probably collected at Monterey, California. The specimen seems to be characteristic *A. Menziesii* Gray of the Californian coast. It is not a South American species and was not collected on the Galapagos Islands.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.